HW Review:

#56: $m = 1000\ kg$ $t = 10\ s$

$\rightarrow +$ $v_i = 20\ m/s$ $v_f = 0\ m/s$

 $F = ?$

$$F\Delta t = m(v_f - v_i)$$

$$F = \frac{m(v_f - v_i)}{\Delta t}$$

$$= \frac{(1000\ kg)(0\ m/s - 20\ m/s)}{10\ s}$$

$$= -2000\ N$$

#57:

$\rightarrow +$

$m_1 = 2\ kg \quad m_2 = 2\ kg$

$v_{1i} = 3\ m/s \quad v_{2i} = 0\ m/s \quad v_f = ?$

This is an inelastic collision.

$$\vec{p}_{1i} + \vec{p}_{2i} = \vec{p}_{total\ final}$$

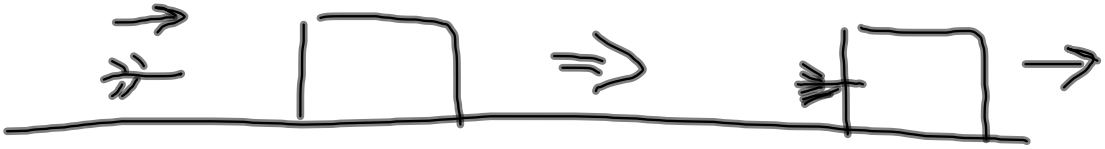
$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

$$v_f = \frac{m_1 v_{1i}}{m_1 + m_2}$$

$$= \frac{(2\ kg)(3\ m/s)}{2\ kg + 2\ kg}$$

$$= 1.5\ m/s$$

#58:



$m_d = 1\ kg \quad m_b = 9\ kg$

$v_{di} = 10\ m/s \quad v_{bi} = 0\ m/s$

$v_f = ?$

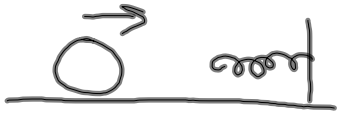
$$m_d v_{di} + \cancel{m_b v_{bi}} = (m_d + m_b) v_f$$

$$v_f = \frac{m_d v_{di}}{m_d + m_b}$$

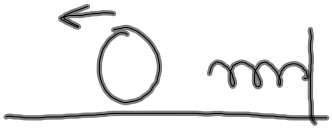
$$= \frac{(1\ kg)(10\ m/s)}{(1\ kg + 9\ kg)}$$

$$= 1\ m/s$$

#59:

$\rightarrow_+$ 1) 

2) 

3) 

a) momentum of ball

$$\bar{p} = m\bar{v}$$
$$= (8\,kg)(2\,m/s)$$
$$= 16\,kg\cdot m/s$$

b) $\Delta\bar{p} = m\Delta\bar{v}$

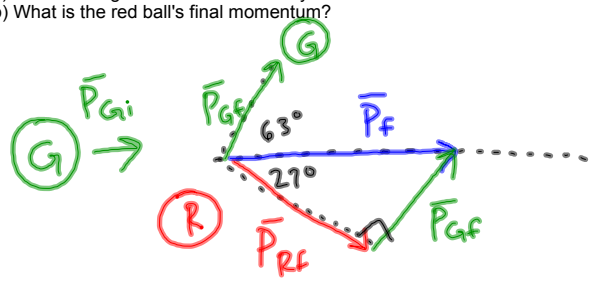
$$= m(\bar{v}_f - \bar{v}_i)$$
$$= (8\,kg)(-2\,m/s - 2\,m/s)$$
$$= -32\,kg\cdot m/s$$

c) Impulse-Momentum Theorem

$$\bar{F}\Delta t = m\Delta\bar{v}$$
$$F = \frac{m\Delta\bar{v}}{\Delta t} \qquad \Delta t = 0.5\,s$$
$$= \frac{-32\,kg\cdot m/s}{0.5\,s}$$
$$= -64\,N$$

HW Review and 2D Elastic Practice Problem 2.9.12 CP Physics

A green 5.00 kg ball moving 17.0 m/s hits a non-moving red 7.00 kg ball. After they hit, the red ball is moving to the right at a 27 degree angle from the green ball's original direction. The green ball is now moving at a 63 degree angle to the left of its original direction.
a) What is the green ball's final velocity?
b) What is the red ball's final momentum?



$$\bar{P}_i = \bar{P}_{Gi} + \cancel{\bar{P}_{Ri}}^{\,0}$$

$$= m_G v_{Gi} = (5\text{ kg})(17\text{ m/s}) = 85\text{ kg·m/s}$$

$$\bar{P}_f = \bar{P}_{Gf} + \bar{P}_{Rf}$$

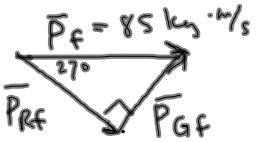
↑ CANNOT simply add, b/c they are vectors!

initial momentum = final momentum

$$\bar{P}_i = \bar{P}_f$$

$$85\text{ kg·m/s east} = \bar{P}_f$$

a) find v_{Gf} → find P_{Gf} first



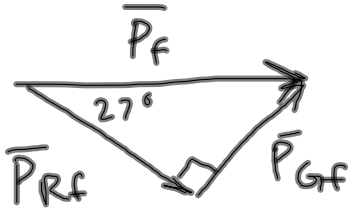
$$\sin(27°) = \frac{P_{Gf}}{P_f}$$

$$P_{Gf} = P_f \sin(27°)$$
$$= (85\text{ kg·m/s})\sin(27°)$$
$$= 38.6\text{ kg·m/s}$$

$$P_{Gf} = m_G v_{Gf}$$

$$v_{Gf} = \frac{P_{Gf}}{m_G} = \frac{38.6\text{ kg·m/s}}{5\text{ kg}} = 7.71\text{ m/s}$$

b) find p_{Rf}



$$\cos(27°) = \frac{P_{Rf}}{P_f}$$

$$P_{Rf} = P_f \cos(27°)$$

$$= (85\ kg\cdot m/s)\cos(27°)$$

$$= 75.7\ kg\cdot m/s$$

Steps:

1) calculate initial momentum from ball that is moving

2) make a final momentum triangle

3) use trigonometry to find each final momentum

4) use momentum to solve for velocity, if necessary

Main Concepts:

Impulse-Momentum

- Force, time, momentum

$$\bar{F}\Delta t = m\Delta\bar{v}$$

Cons. of Momentum

Elastic Collisions

1-D

$$m_1\bar{v}_{1i} + m_2\bar{v}_{2i} = m_1\bar{v}_{1f} + m_2\bar{v}_{2f}$$

$$\bar{p}_{1i} + \bar{p}_{2i} = \bar{p}_{1f} + \bar{p}_{2f}$$

2-D

Inelastic Collisions

1-D

objects apart, then stick together

$$m_1\bar{v}_{1i} + m_2\bar{v}_{2i} = (m_1+m_2)\bar{v}_f$$

objects together, then move apart

$$(m_1+m_2)\bar{v}_i = m_1\bar{v}_{1F} + m_2\bar{v}_{2f}$$

2-D